PATENT ABSTRACTS OF JAPAN

(11)Publication number : 08-293459

(43)Date of publication of application : 05.11.1996

---

(51)Int.Cl. H01L 21/027
G05D 3/12
H01L 21/68

---

(21)Application number : 07-120825

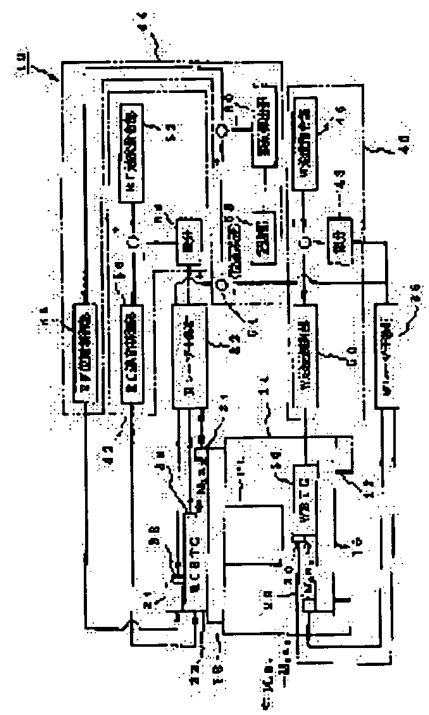
(22)Date of filing : 21.04.1995

(71)Applicant : NIKON CORP

(72)Inventor : TOKUNAGA MASAAKI

---

(54) STAGE DRIVING CONTROL METHOD AND ITS DEVICE



(57)Abstract:

PURPOSE: To shorten synchronization setting time between a substrate stage and a mask stage.

CONSTITUTION: When a reticle coarse adjustment stage 22 and a wafer stage 20 is simultaneously scanned in a predetermined scanning direction for exposure, a position control system 44 for a reticle fine adjustment stage detects a positional displacement quantity between the wafer stage 20 and a reticle fine adjustment stage 24 and at the same time computes the vibration quantity of a vibration resistant base 12, and the driving of both stages 20, 22 is controlled so that positional displacement is corrected on the basis of the detected positional displacement and the vibration quantity. For that reason, even when a vibration is generated in the vibration resistant base 12 at the time of acceleration for the scanning of the stages 20, 22, an error due to the influence of the vibration is taken into consideration and the positional relationship between the stages 20, 24 is corrected so as to make a predetermined synchronization relationship at a predetermined time interval.

LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] this invention relates to the stage drive control method suitable as the so-called object for scan type aligners which starts the drive control method of a stage, and its equipment, especially imprints the pattern on a mask to a sensitization substrate, moving a mask stage and a substrate stage to a predetermined scanning direction synchronously, respectively, and its equipment.

[0002]

[Description of the Prior Art] A scan type aligner is an aligner which a substrate stage and a mask stage (reticle stage) are simultaneously accelerated in an opposite direction or the same direction, and the speed of each stage after an acceleration end is synchronized, and imprints the pattern on a reticle through a projection optical system to the sensitization substrate on a substrate stage.

[0003] The example of composition of the stage drive control system of the conventional scan type projection aligner used by the semiconductor manufacturing process is roughly shown in drawing 4 .

[0004] In this scan type aligner, the laser interferometer 70 for wafers and the laser interferometer 72 for reticles detected the position of the wafer stage (substrate stage) 74 and a reticle stage (mask stage) 76, respectively, and the speed is simultaneously controlled in these stages 74 and 76. As shown in this drawing 4 , and the position error of both the stages 74 and 76 obtained from the output of both the interferometers 70 and 72 By feeding back to the speed instruction section 78 one of stages, for example, for reticle-stage 76, and giving speed instructions whose speed instruction section 78 cancels a part for this error to the speed-control section 80 for reticle-stage 76 The speed-control section performs speed control of a reticle stage 76 based on the speed (detection value) of the reticle stage 76 from which 80 is obtained from the output of these speed instructions and a laser interferometer 72.

[0005]

[Problem(s) to be Solved by the Invention] However, since the reticle stage 76 with big mass had to be controlled by the drive control method of the conventional stage mentioned above in order to make the position of a reticle stage 76 follow the position of the wafer stage 74 and to double it with it, there was un-arranging [that a response will be overdue].

[0006] Moreover, in order to make the stages 74 and 76 where mass is big scan, vibration arises in the shock absorbing desk 82 in which it originated in the difference (M1a1-M2a2) of the reaction force of the thrust applied to stages 74 and 76, and stages 74 and 76 were laid, it originates in this vibration, and the fixed mirrors 84 and 86 for each laser interferometers vibrate. In this case, in fact, although it will be satisfactory if the fixed mirror 84 and the fixed mirror 86 vibrate similarly, since the transfer functions from the shock absorbing desk 82 to each fixed mirrors 84 and 86 differ, an amplitude etc. is different. For this reason, although a part for the error resulting from vibration with the fixed mirror 84 and the fixed mirror 86 is contained in the position error which is a difference of the measured value of interferometers 70 and 72 Since the position error carried out like ****, it was fed back and speed control (position control) of a reticle stage 76 was performed based on this, when vibration is subsided The reticle stage 76 will have shifted from the original target position, it moved to the original target position, and there was un-arranging [of having taken time before both stages are in a desired synchronous state].

[0007] The example was taken inconvenient, it was made and the purpose is in offering the drive control method of the stage where this conventional technology has this invention and which can shorten the synchronous settling time of a substrate stage and a mask stage, and its equipment.

[0008]

[Means for Solving the Problem] Invention according to claim 1 holds a mask. The mask stage which can move to a predetermined scanning direction, It is the stage drive control method used for the aligner which held the sensitization substrate and was equipped with the substrate stage movable to the aforementioned scanning direction. An exposure sake, The aforementioned mask stage and the aforementioned substrate stage are faced scanning simultaneously to a predetermined scanning direction. at intervals of a predetermined time Drive control of both the aforementioned stages is carried out so that the position gap between both the aforementioned stages may be amended based on the amount of vibration by which computed the amount of vibration of the shock absorbing desk in which the aforementioned substrate stage was laid while detecting the amount of position gaps between both the aforementioned stages, and calculation was carried out [aforementioned] with the amount of position gaps by which detection was carried out [aforementioned].

[0009] Invention according to claim 2 holds a mask. The mask stage which can move to a predetermined scanning direction, Are used for the aligner which held the sensitization substrate and was equipped with the substrate stage movable to the aforementioned scanning direction. It is a stage drive control unit. So that the 1st stage control system which performs speed control of one stage of the aforementioned mask stage and the aforementioned substrate stages,; aforementioned one stage, and the stage of another side may become a position relation It has the 2nd stage control system which carries out drive control of the stage of aforementioned another side synchronizing with the speed control of aforementioned one stage. And it has the control means which perform speed control of the stage of aforementioned another side based on the amount of vibration by which calculation was carried out [aforementioned] with the position error by which the; aforementioned detection was carried out with a position error detection means by which the 2nd stage control system of the above detects the position error of both the aforementioned stages, and an operation means to calculate the amount of vibration of the shock absorbing desk in which the; aforementioned substrate stage was laid at intervals of a predetermined time.

[0010] Invention according to claim 3 holds a mask. The mask stage which can move to a predetermined scanning direction, Are used for the aligner which held the sensitization substrate and was equipped with the substrate stage movable to the aforementioned scanning

direction. It is a stage drive control unit. This 1st movable to aforementioned scanning direction stage, and 1st stage top The aforementioned scanning direction is met. the 2nd stage which can be displaced relatively So that the 1st speed-control system which performs speed control of the aforementioned mask stage which it has, and the; aforementioned substrate stage, the 2nd speed-control system which performs speed control of the 1st stage of; above, the; aforementioned substrate stage, and the 2nd stage of the above may become a position relation It has the stage position control system which controls the position of the 2nd stage of the above synchronizing with the speed control by the above 1st and the 2nd speed-control system. And the aforementioned stage position control system The position error of the aforementioned substrate stage and the 2nd stage of the above The position error detection means and; to detect The shock absorbing desk in which the aforementioned substrate stage was laid The operation means and; which calculate the amount of vibration of the aforementioned shock absorbing desk at intervals of a predetermined time based on the thrust of the storage section and the; aforementioned damping coefficient the damping coefficient and the spring constant were remembered to be at least, and spring constant of the included secondary vibration system, the aforementioned substrate stage, and the 1st stage of the above, and the transfer function of the aforementioned secondary vibration system It has the control means which perform position control of the 2nd stage of the above based on the amount of vibration by which calculation was carried out [aforementioned] with the position error by which detection was carried out [aforementioned].

[0011]

[Function] According to invention according to claim 1, it faces scanning a mask stage and a substrate stage simultaneously to a predetermined scanning direction for exposure. at intervals of a predetermined time Drive control of both the stages is carried out so that the amount of vibration of the shock absorbing desk in which the substrate stage was laid may be computed while detecting the amount of position gaps between both stages, and the position gap between both stages may be amended based on the detected amount of position gaps, and the computed amount of vibration. For this reason, when a laser interferometer detects the position of both stages, even if vibration occurs in a shock absorbing desk at the time of the acceleration for the scan of both stages, since it is amended so that the physical relationship of both stages may turn into a predetermined synchronous relation at intervals of a predetermined time in consideration of the error under the influence of this vibration, when completed by vibration, both stages are in the synchronous state, for example.

[0012] According to invention according to claim 2, by the 1st stage control system, speed control of an one stage of a mask stage and the substrate stages, for example, a substrate stage, is performed. At this time, by the 2nd stage control system, synchronizing with the speed control of a substrate stage, drive control of the stage of another side, for example, the mask stage, is carried out so that both stages may become a position relation. Under the present circumstances, with a position error detection means to constitute the 2nd stage control system, the position error of both stages is detected and the amount of vibration of the shock absorbing desk in which the substrate stage was laid is calculated at intervals of a predetermined time in an operation means. And in control means, speed control of a mask stage is performed based on the detected position error and the computed amount of vibration. For this reason, when a laser interferometer detects the position of both stages, even if vibration occurs in a shock absorbing desk at the time of the acceleration for the scan of both stages, since it is amended so that the physical relationship of both stages may turn into a predetermined synchronous relation at intervals of a predetermined time in consideration of the error under the influence of this vibration, when completed by vibration, both stages are in the synchronous state, for example.

[0013] According to invention according to claim 3, speed control of a substrate stage is performed by the 1st speed-control system, and speed control of the 1st stage is performed by the 2nd speed-control system. At this time, synchronizing with the speed control by the 1st and 2nd speed-control system, the position of the 2nd stage is controlled by the stage position control system so that a substrate stage and the 2nd stage become a position relation. Under the present circumstances, with a position error detection means to constitute a stage position control system, the position error of a substrate stage and the 2nd stage is detected, and in an operation means, even if there is little secondary vibration system containing the shock absorbing desk in which the substrate stage was laid, based on the thrust of a damping coefficient, a spring constant, a substrate stage, and the 1st stage, and the transfer function of secondary vibration system, the amount of vibration of a shock absorbing desk is calculated at intervals of a predetermined time. And in control means, position control of the 2nd stage is performed based on the detected position error and the computed amount of vibration.

[0014] For this reason, when a laser interferometer detects the position of a substrate stage and the 2nd stage, even if vibration occurs in a shock absorbing desk at the time of the acceleration for the scan of a substrate stage and the 1st stage, for example Since it is amended so that the physical relationship of a substrate stage and the 2nd stage may turn into a predetermined synchronous relation at intervals of a predetermined time in consideration of the error under the influence of this vibration When completed by vibration, if mass of the 2nd stage is made small in addition to being in a synchronous state, a substrate stage and the 2nd stage can follow a substrate stage, and can improve [responsibility] the 2nd stage position control.

[0015]

[Example] Hereafter, one example of this invention is explained based on drawing 1 or drawing 3 .

[0016] The composition of the stage drive control unit 10 concerning one example applied to the scan type aligner is shown in drawing 1 .

[0017] In drawing 1 , on a shock absorbing desk 12, the main part column 14 and the wafer susceptor 16 are laid, and the reticle susceptor 18 is laid on the main part column 14.

[0018] On the wafer susceptor 16, the wafer stage (WSTG) 20 as a substrate stage is formed possible [movement in the direction (the space rectangular cross direction in drawing 1) which intersects perpendicularly with a scanning direction (longitudinal direction in drawing 1), and this]. Moreover, on the reticle susceptor 18, the reticle flutter stage (RCSTG) 22 as the 1st stage where mass is big is formed possible [movement to a scanning direction (longitudinal direction in drawing 1)], and the reticle jogging stage (RFSTG) 24 as the 2nd stage where mass is small is formed possible [jogging] on this reticle flutter stage 22 at the scanning direction. That is, the mask stage consists of this examples including the reticle flutter stage 22 and the reticle jogging stage 24.

[0019] It is arranged towards the direction where the move side of the wafer stage 20 concerned and a projection optical system PL cross the optical axis at right angles above the wafer stage 20, and is held at the main part column 14. If the wafer as a sensitization substrate is laid on the wafer stage 20 and the reticle as a mask is laid on the reticle jogging stage 24, it is made for the pattern side and wafer front face of a reticle to serve as conjugate about a projection optical system PL.

[0020] On the wafer susceptor 16, the fixed mirror 28 for laser interferometer 26 for wafers is installed by the end (left end in drawing 1) of a scanning direction in the scanning rectangular cross direction (the space rectangular cross direction in drawing 1), and the move mirror 30 for laser interferometer 26 for wafers is installed in the scanning rectangular cross direction by the end of the scanning direction of the wafer stage 20 corresponding to this.

[0021] Similarly, on the reticle susceptor 18, the fixed mirror 34 for laser interferometer 32 for reticles is installed in the scanning rectangular cross direction (the space rectangular cross direction in drawing 1) by the other end (right end in drawing 1) of a scanning direction, and the 1st for laser interferometer 32 for reticles and the 2nd move mirror 36 and 38 are installed in the scanning rectangular cross direction by the other end of the scanning direction of the reticle flutter stage 22 and the reticle jogging stage 24 corresponding to this, respectively.
[0022] The laser interferometer 26 for wafers which receives each reflected light both as if the stage drive control unit 10 irradiates a laser beam towards the fixed mirror 28 and the move mirror 30, respectively, and detects the position of the wafer stage 20, The laser interferometer 32 for reticles which receives each reflected light both as if a laser beam is irradiated towards the fixed mirror 34 and the 1st, and 2nd move mirror 36 and 38, respectively, and detects the position of the reticle flutter stage 22 and the reticle jogging stage 24, respectively, It has the speed-control system 40 for wafer stages as 1st speed-control system, the speed-control system 42 for reticle flutter stages as 2nd speed-control system, and the position control system 44 for reticle jogging stages as a stage position control system.
[0023] The speed-control system 40 for wafer stages is constituted including the speed-control section 50 for wafer stages which performs speed control of the wafer stage 20 through the drive system which is not illustrated based on the speed instruction section 46 for wafer stages, the differential circuit 48 which differentiates the positional information of the wafer stage 20 which is the output of a laser interferometer 26, and calculates the speed of the wafer stage 20, and the speed instructions from the wafer speed instruction section 46 and the speed calculated by the differential circuit 48.
[0024] The speed-control system 42 for reticle rough ** stages The speed instruction section 52 for reticle rough ** stages, The differential circuit 54 which differentiates the positional information of the reticle rough ** stage 22 which is one output of the laser interferometer 32 for reticles, and calculates the speed of the reticle rough ** stage 22, It is constituted including the speed-control section 56 for reticle rough ** stages which performs speed control of the reticle rough ** stage 22 through the drive system which is not illustrated based on the speed instructions from the speed instruction section 52 for reticle rough ** stages, and the speed calculated by the differential circuit 54.
[0025] Furthermore, the position control system 44 for reticle jogging stages The storage section 58 the data for computing the amount of vibration of a shock absorbing desk 12 were remembered to be, The oscillating calculation section 60 as an operation means to compute the amount of vibration of a shock absorbing desk 12 by the technique later mentioned based on the data memorized by this storage section 58, It is constituted including the position control section 62 for reticle jogging stages as control means which control the position of the reticle jogging stage 24 based on the position error of this amount of vibration, wafer stage 20, and reticle jogging stage 24 that were computed. Here, the position error of the wafer stage 20 and the reticle jogging stage 24 is calculated by the subtractor 64 based on the positional information of the wafer stage 20 which is the output of the laser interferometer 26 for wafers, and the positional information of the reticle jogging stage 24 which is the output of another side of the laser interferometer 32 for reticles. That is, the position error detection means is constituted from this example by the laser interferometer 26 for wafers, the laser interferometer 32 for reticles, and the subtractor 64. Moreover, position control of the reticle jogging stage 24 by the position control section 62 for reticle jogging stages is performed through the drive system which is not illustrated.
[0026] Next, the calculation method of the amount of vibration of the shock absorbing desk 12 by the oscillating calculation section 60 is explained based on drawing 2 . The block diagram of the above-mentioned vibration system at the time of considering shock absorbing desks 12 to be spring constant K and the secondary vibration system which has a damping coefficient D is shown in drawing 2 . If all initial condition carries out the Laplace transform of the equation of motion of this system as zero, the following formula (1) which is the relational expression of Input F and Output X which are shown by the block diagram of drawing 2 can be found.
[0027]
[Equation 1]
X=1/(Ms2+Ds+K) andF ...... (1)
here -- 1/(Ms2+Ds+K): -- mass F: of the equipment containing the transfer function M:shock absorbing desk 12 and the main part column 14 of this vibration system -- external force X: which is the input of this vibration system -- the shock-absorbing-desk position (the amount of vibration) which is the output of this system
[0028] It asks for spring constant K and a damping coefficient D experimentally, and when the wafer stage 20 and the reticle flutter stage 22 are scanned on the same conditions as the time of exposure using these values, an example of the simulation data which performed as an input external force F which joins a system is shown in drawing 3 . In this drawing 3 , a horizontal axis shows time, and a vertical axis shows the shake of a shock absorbing desk (the amount of vibration).
[0029] this example -- beforehand -- the storage section 58 -- spring constant K, a damping coefficient D, the mass M1 of a reticle flutter stage, and mass M2 of a wafer stage The value is memorized. for scanning exposure When the reticle flutter stage 22 and the wafer stage 20 are simultaneously accelerated by the reverse sense, in the oscillating calculation section 60 An upper formula (1) is followed by making into external force F the difference (M1a1-M2a2) of thrust M1a1 added to the reticle flutter stage 22, and thrust M2a2 which are added to the wafer stage 20. The amount X of vibration is computed at intervals of a predetermined time, and it asks for the shake X of the shock absorbing desk 12 as shown by drawing 3 (the amount of vibration).
[0030] In addition, since the mass of the reticle jogging stage 24 is small enough compared with the mass of the reticle flutter stage 22, the influence on external force F does not need to take into consideration.
[0031] Here, thrust M1a1 and thrust M2a2 are the acceleration a1 of the reticle flutter stage 22, and the acceleration a2 of the wafer stage 20. The mass M1 of each stage, and M2 It takes advantaging, respectively and asks.
[0032] Or a simulation which was mentioned above under the same conditions as the time of exposure is performed as another technique, the result is memorized in the storage section 58 in the form of a map, and it is also possible to compute the amount of vibration based on this map at intervals of a predetermined time at the time of scanning exposure.
[0033] According to this example constituted as mentioned above, on the occasion of the scanning start of a stage, the speed instruction section 52 for reticle flutter stages and the speed instruction section 46 for wafer stages generate speed instructions to each speed-control sections 56 and 50.
[0034] The speed-control section 56 for reticle flutter stages and the speed-control section 50 for wafer stages start the speed control of the reticle flutter stage 22 and the wafer stage 20 according to each speed instructions.
[0035] ** [a start of the scan of a stage / continue / speed control / thus, / the speed-control section 56 for reticle flutter stages and the speed-control section 50 for wafer stages / by the technique mentioned above based on speed instructions and the detected speed]
[0036] At this time, the monitor of the position of the wafer stage 20 and the reticle jogging stage 24 is carried out by interferometers 26

and 32, respectively, and the position error of both the stages 20 and 24 calculates within the position control system 44 for reticle jogging stages based on such positional information. The amount of vibration of the shock absorbing desk 12 resulting from the difference (M1a1-M2a2) of the reaction force of the thrust for acceleration of the reticle flutter stage 22 where mass is large, and the wafer stage 20 is computed at intervals of a predetermined time by the technique which could come, simultaneously was mentioned above in the oscillating calculation section 60. Based on the position error of both the stages 20 and 24, and the amount of vibration of the computed shock absorbing desk 12, the position of the reticle jogging stage 24 is controlled by the position control section 62 for reticle jogging stages.

[0037] Although the error for the fixed mirror 28 resulting from vibration of a shock absorbing desk 12 and the shake of 34 is included in the position error based on the output of interferometers 26 and 32, at this example, the amount of vibration is computed in the oscillating calculation section 60, and the position of the reticle jogging stage 24 is controlled by the position control section 58 for reticle jogging stages based on the position error based on the output of interferometers 26 and 32, and the computed amount of vibration. For this reason, since position control of the reticle jogging stage 24 is carried out, when completed by vibration, the reticle jogging stage 24 is located to the target position, can shorten the synchronous settling time of the wafer stage 20 at the time of an acceleration end, and the reticle jogging stage 24, where the influence of vibration is canceled, thereby, can raise the processing speed of an aligner and can expect increase of the wafer quantity of production. Moreover, since the inlet length of each stage until the wafer stage 20 and the reticle jogging stage 24 will be in a desired synchronous state can be shortened, the miniaturization of the part equipment is attained.

[0038] In addition, although the case where differentiated the positional information of laser interferometers 26 and 32, and it changed into speed information was illustrated in the above-mentioned example, you may carry out direct detection of the traverse speed of a stage using speed-detection meanses, such as a tacometer generator.

[0039] Moreover, although the above-mentioned example showed each part which constitutes the speed-control system 40 for wafer stages, the speed-control system 42 for reticle flutter stages, and the position control system 44 grade for reticle jogging stages as respectively separate functional block, it is also possible to realize all three systems by the function of a single processor as well as each of these speed-control systems 40 for wafer stages, the speed-control system 42 for reticle flutter stages, and the position control system 44 for reticle jogging stages.

[0040] In addition, the reticle flutter stage 22 where only speed control is performed in the above-mentioned example, A reticle stage is constituted including the reticle jogging stage 24 where amendment of a position gap error is performed. Although the case where the 1st stage control system was constituted by the speed-control system 40 for wafer stages, and the 2nd stage control system was constituted by the speed-control system 42 for reticle flutter stages and the position control system 44 for reticle jogging stages was illustrated Even if it applies this invention to equipment like the conventional example of <u>drawing 4</u> which it is not limited to this and mentioned above, it is effective. In this case, the speed is simultaneously controlled in a reticle stage and a wafer stage. In case the position error (or speed error) of both stages is fed back to the speed-control system of one of stages, for this error By performing speed control of a stage, where a part for the error of the interferometer detection value which originates in vibration of a shock absorbing desk with the amount of vibration computed in the oscillating calculation section is canceled, since the error of the interferometer detection value resulting from vibration of a shock absorbing desk was included It becomes possible to shorten the synchronous settling time of both stages.

[0041] Moreover, in the above-mentioned example, you may be made to make adjustable time (or section) to add vibration of a shock absorbing desk 12 to the jogging stage 24 rather than to add vibration of a shock absorbing desk 12 to the jogging stage 24 till an oscillating end. Making the jogging stage 24 carry out excessive movement by this is lost, and the synchronous settling time can be controlled with a sufficient precision.

[0042]

[Effect of the Invention] Even if vibration occurred in a shock absorbing desk at the time of the acceleration for the scan of both stages, when a laser interferometer detects the position of a mask stage and a substrate stage according to this invention, and it is completed by vibration, since both stages are in a synchronous state, they have [as having explained above,] the outstanding effect which is not in the former that the synchronous settling time of a substrate stage and a mask stage can be shortened.

[0043] Since mass of the 2nd stage can be especially made small according to invention according to claim 3, it is effective in the ability of responsibility to follow a sensitization substrate in addition to the above-mentioned effect, and improve a reticle position control.

[Translation done.]

CLAIMS

[Claim(s)]
[Claim 1] It faces being the stage drive control method which is characterized by providing the following and which is used for an aligner, and scanning the aforementioned mask stage and the aforementioned substrate stage simultaneously to a predetermined scanning direction for exposure. at intervals of a predetermined time The amount of vibration of the shock absorbing desk in which the aforementioned substrate stage was laid while detecting the amount of position gaps between both the aforementioned stages is computed. The stage drive control method which carries out drive control of both the aforementioned stages so that the position gap between both the aforementioned stages may be amended based on the amount of vibration by which calculation was carried out [aforementioned] with the amount of position gaps by which detection was carried out [aforementioned]. A mask is held and it is the mask stage which can move to a predetermined scanning direction. A sensitization substrate is held and it is a substrate stage movable to the aforementioned scanning direction.
[Claim 2] Hold a mask and are used for the mask stage which can move to a predetermined scanning direction, and the aligner which held the sensitization substrate and was equipped with the substrate stage movable to the aforementioned scanning direction. It is a stage drive control unit. So that the 1st stage control system which performs speed control of one stage of the aforementioned mask stage and the aforementioned substrate stages,; aforementioned one stage, and the stage of another side may become a position relation It has the 2nd stage control system which carries out drive control of the stage of aforementioned another side synchronizing with the speed control of aforementioned one stage. The 2nd stage control system of the above The position error of both the aforementioned stages The stage drive control unit which has the control means which perform speed control of the stage of aforementioned another side based on the amount of vibration by which calculation was carried out [aforementioned] with the position error by which the; aforementioned detection was carried out with a position error detection means to detect, and an operation means to calculate the amount of vibration of the shock absorbing desk in which the; aforementioned substrate stage was laid at intervals of a predetermined time.
[Claim 3] Hold a mask and are used for the mask stage which can move to a predetermined scanning direction, and the aligner which held the sensitization substrate and was equipped with the substrate stage movable to the aforementioned scanning direction. It is a stage drive control unit. This 1st movable to aforementioned scanning direction stage, and 1st stage top The aforementioned scanning direction is met. the 2nd stage which can be displaced relatively So that the 1st speed-control system which performs speed control of the aforementioned mask stage which it has, and the; aforementioned substrate stage, the 2nd speed-control system which performs speed control of the 1st stage of; above, the; aforementioned substrate stage, and the 2nd stage of the above may become a position relation It has the stage position control system which controls the position of the 2nd stage of the above synchronizing with the speed control by the above 1st and the 2nd speed-control system. The aforementioned stage position control system The position error of the aforementioned substrate stage and the 2nd stage of the above The position error detection means and; to detect The shock absorbing desk in which the aforementioned substrate stage was laid The operation means and; which calculate the amount of vibration of the aforementioned shock absorbing desk at intervals of a predetermined time based on the thrust of the storage section and the; aforementioned damping coefficient the damping coefficient and the spring constant were remembered to be at least, and spring constant of the included secondary vibration system, the aforementioned substrate stage, and the 1st stage of the above, and the transfer function of the aforementioned secondary vibration system The stage drive control unit which has the control means which perform position control of the 2nd stage of the above based on the amount of vibration by which calculation was carried out [aforementioned] with the position error by which detection was carried out [aforementioned].

[Translation done.]